Physico-chemical and sensory evaluation of Shrikhand Prepared from cow and goat milk

Abstract

Shrikhand is a semi-solid, sweetish-sour, wholesome indigenous fermented dairy product of western India. It is most popular in Gujarat, Maharashtra and Karnataka. It is popular because of its characteristics flavour, taste, palatable nature and therapeutic value. The present study was made with an attempt to develop a Goat milk *shrikhand* blended with cow milk. Studied for its sensory quality on various attributes such as flavour, body and texture, color and appearance, and over all acceptability by semi trained panelist using 9-point hedonic scale. In the present investigation treatment T_0, T_1, T_2, T_3 and T_4 were formulated in which *shrikhand* was prepared by using 40% sugar with various proportion of cow milk and goat milk blended chakka, in the ratio of 100:00, 75:25, 50:50, 25:75 and 0:100, respectively. The sensory scores for overall acceptability of cow and goat milk blended *shrikhand* of treatments T_0, T_1, T_2, T_3 and T_4 were 8.14, 8.15, 8.20, 8.17 and 8.14 respectively. It was found that among all treatments under study, treatment T_2 scored higher in sensory evaluation and was considered as optimized product of goat milk *shrikhand*. The sensorily superior treatment T_2 contain fat, protein, reducing sugar, total sugar, total solids, moisture and ash 8.50, 7.65, 2.24, 42.22, 58.37 and 41.63 per cent, respectively.

Key words: *Shrikhand*, sensory evaluation, Physico-chemical properties, sugar, goat milk, cow milk.

1.0 Introduction

India is currently the largest producer of milk in the world which is 16 per cent to the world milk production (Lakshmi, A., and Nagaraja, G. N. 2022) the name *Shrikhand* is derived from the Sanskrit word "Shrikarini" which means a curd prepared with the addition of sugar, flavouring material, etc. In western india *shrikhand* is a semisolid, sweetish-sour wholesome, indigenous fermented milk product. (Shridharrao, 2012). dairying is an important sub-sector of the farming system of the Indian economy (Kaur, N., and Toor, J. 2023). Chakka is the traditional product obtained after whey drainage from dahi obtained by lactic acid fermentation of milk. *Shrikhand* is made from skim or whole milk from cows or from reconstituted skim milk combined with standardized milk. The color is yellowish from cow milk and it should have a pleasant yogurt-like flavor (Pandya *et al*., 2006; Chauhan et al., 2024). India occupies the first position in global goat milk production (6.09 million tonnes) and in India goat is 3rd (3% of total milk) largest milk contributing species (DAHD 2019; Singh *et al*., 2023; Maske et al., 2024). World-wide goat milk in 2018 has surpassed 18.71 million tonnes (FAOSTAT 2018) and India with 6.17 million tonnes of milk is contributing 33% of global goat milk production. Goat and sheep milk are widely used for home consumption and to produce different dairy product, which makes them of particular economic value in countries (Pandya and Ghodke, 2007). Goat milk has great contribution to the health and nutrition of the landless and rural poor so they have been referred to as the "poor man's cow" (Dresch, 1988). Goat milk is having better digestibility, alkalinity, buffering capacity and certain therapeautic values in medicine and human nutrition (Park and Chukwu, 1989; Park, 1994; Chauhan et al., 2024; Maske et al., 2024). Different goat milk products like dry whole milk, dried granulated milk, condensed goat milk, fruit yogurt, cheeses, butter and butter oil, cultured goat cream butter, ice cream, *shrikhand*, whey protein concentrate (WPC), evaporated milk and traditional Indian products have been reported (Chilliard *et al*., 2006, Pandya and Ghodke 2007).

2.0 Materials and Methodology:

Fresh goat milk and cow milk was obtained from the dairy farm MPKV Rahuri. Dahi culture (LF-40) was procured from National Collection of Dairy Cultures, National Dairy Research Institute, Karnal.

T_0-Control (100% cow milk) + sugar

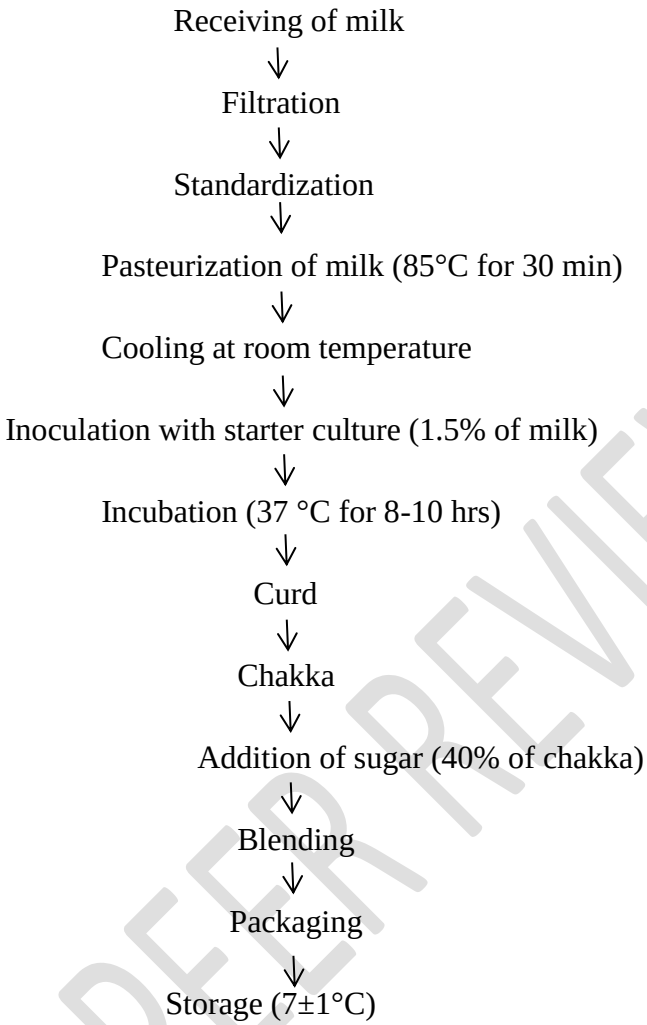
T_1- 25% goat milk + 75% cow milk + sugar

T_2-50% goat milk+50% cow milk + sugar

T_3-75% goat milk+25% cow milk + sugar

T_4-100% goat milk + sugar

Chart -1-Preparation of *shrikhand*:



2.1 Analysis of the product

2.1.1 Sensory evaluation of *shrikhand*

The fresh *shrikhand* samples were provided to the 5 semi-trained judges for sensory evaluation. samples score was evaluated for flavor, body, and texture, colour, and appearance and overall acceptability by using a 9-point hedonic scale as per IS: 6273 (part II) 1971.

2.1.2 Physico-Chemical analysis

Control and treatment groups of *Shrikhand* were analyzed for pH, Acidity, Fat, Protein, Moisture, Total Sugar, Reducing Sugar, Total Ash and Total solids. The pH of *shrikhand* samples was analyzed by Cyber Scan 2500 digital pH meter (Eutech). The Acidity, fat content & total solids and ash content of *shrikhand* samples was determined according to the procedure described by the FSSAI (2015). Moisture and Protein content was determined as per AOAC (1995). Total sugar and reducing sugar content were determined as per AOAC (2000).

3.0 Result and Discussion:

3.1 Sensory evaluation of *shrikhand*

Fig 1.0, present the mean score for flavour, body and texture, colour and appearance and Overall acceptability of control sample (100% cow milk *shrikhand*) were 8.15±0.001, 8.25±0.01, 8.03±0.02, 8.14±0.002. and the corresponding scores for 50% goat milk+50% cow milk *shrikhand* were 8.14±0.001, 8.28±0.01, 8.18±0.01 and 8.20±0.002 respectively. Slightly significant difference in sensory scores was observed between the samples.

This similar investigation it can be concluded that treatment T_3 with 30 per cent jamun pulp and 70 per cent buffalo milk chakka was significantly superior over treatment T_0, T_1 and T_2 which had the highest sensory score with respect to colour and appearance, flavour, taste and consistency. (Chavan P B., 2019) *Shrikhand* give better chemical and textural and sensorial properties and results were in accordance with the findings of (Deshmukh N. M., 2017) The good quality *shrikhand* prepared from goat milk and observed significant sensorial value by (Agnihotri and Pal, 1996) *Shrikhand* is prepared from goat milk by added kiwi fruit and significant sensorial value observed for colour, taste & flavor, texture, overall acceptability as 8.35±0.05, 8.12±0.05, 7.88±0.07, 8.0±0.05 respectivelyy. (Pathrikar, A.D., 2021).

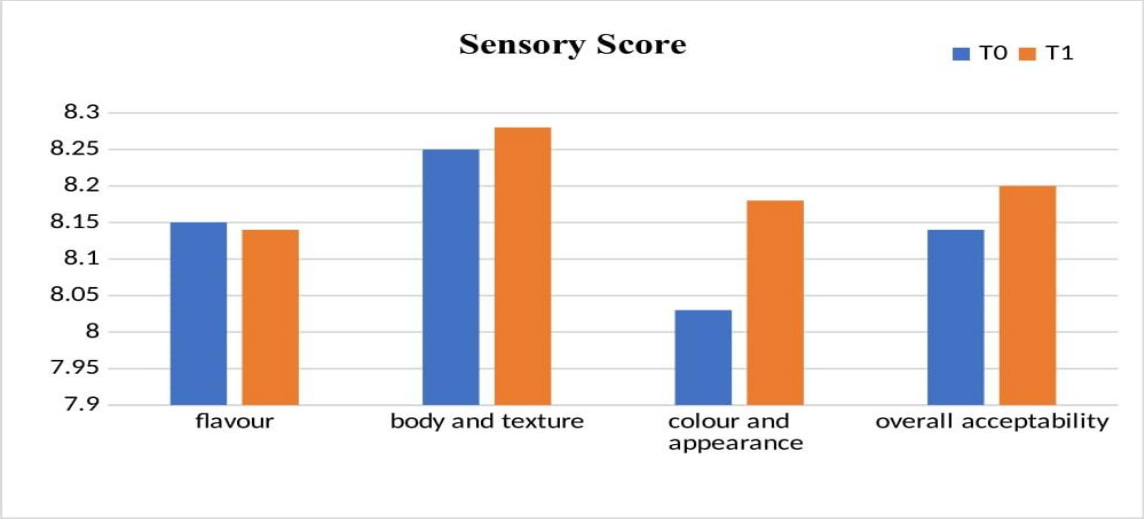


Fig 1.0 Sensory evaluation of *shrikhand*

3.2 Physico-Chemical analysis

3.2.1 pH

The pH content in the developed product *shrikhand* as found to be 4.72±0.01, 4.70±0.01, 4.68±0.01, 4.68±0.01 and 4.67±0.01 per cent for treatment T_0, T_1, T_2, T_3 and T_4, respectively the

treatment T_0 and T_2 was significantly different from each other at 5% level of significance. The results were in accordance with the findings of (Patel and Chakraborty, 1985 ; David, 2015) who obtained pH values of 4.1 and 4.36 respectively in *shrikhand*.

3.2.2 Acidity

The mean titratable acidity of control *shrikhand* as found to be 0.81±0.01, 0.82±0.02, 0.90±0.01, 0.93±0.01 and 0.95±0.02 for treatment T_0, T_1, T_2, T_3 and T_4 percent lactic acid respectively. Statistical analysis revealed slightly significant difference in titratable acidity between both controls and treatment *shrikhand* sample. The results were also in accordance with the legal standards of IS: 95321-1980. According to Food safety and standards regulations (2010), the titratable acidity of *shrikhand* should not be more than 1.4 per cent lactic acid. All *shrikhand* samples met with this legal standard.

3.2.3 Fat

The mean fat per cent of control *shrikhand* as found to be 7.85±0.12, 7.91±0.12, 8.50±0.12, 8.57±0.12 and 8.67±0.12 for treatment T_0, T_1, T_2, T_3 and T_4 percent respectively. Fat per cent of *shrikhand* showed a statistically significant difference between (T_0) control *shrikhand and* (T_2) treatment. *shrikhand* which was in close resemblance with the findings of (Bhandage B. *et al*., 2020) who obtained fat values between 8.21 to 8.75 per cent respectively. this result was in similar with the legal standard specified for *shrikhand* (FSSR, 2011).

3.2.4 Protein

The average protein content of the *shrikhand* samples was found to be 7.30±0.05, 7.58±0.06, 7.65±0.04, 7.90±0.07, and 8.00±0.09 per cent for treatment T_0, T_1, T_2, T_3 and T_4 percent respectively. There was significantly difference between the protein content of both controls and treatment *shrikhand* sample. Similar result was reported by incorporation of WPC had significantly increased the protein per cent in the treatment group of *shrikhand* (Shaji, N. and Thomas, S., 2018) which was in close resemblance with the findings of (Sameem *et al.,* 2018) which obtained the protein content of product ranged from 9.1- 8.41 per cent.

3.2.5 Moisture

The average moisture content of finished product was to be found as 42.00±0.13, 41.69±0.16, 41.63±0.09, 40.75±0.12 and 40.57±0.11 per cent for treatment T_0, T_1, T_2, T_3 and T_4 percent respectively. It is observed that significantly difference between the moisture content of both controls (T_0) and treatment (T_2) *shrikhand* sample. (Sameem *et al.,* 2018) reported that the level of dragon fruit pulp increased, the moisture content in *shrikhand* also increased. It shows that average mean scores of

moisture ranges from 42.7, 43.98, 45.25 and 46.52 for the treatments T_0, T_1, T_2 and T_3, respectively. (Sharma S. *et al*., 2017) stated that moisture content in *shrikhand* increased may be due to increase in the proportion of sapota pulp. the moisture content of control *shrikhand* (50.23%) in this study was in accordance with the finding of (Mehta, M., 2013) who observed 45 to 52% of moisture in *shrikhand* collected form Mumbai city.

3.2.6 Total Sugar

It was observed that the average moisture content of finished product was to be found as 42.28±0.01, 42.25±0.02, 42.22±0.02, 42.20±0.01 and 42.17±0.02 per cent for treatment T_0, T_1, T_2, T_3 and T_4 percent respectively. The results were also in accordance with the Jaybhay, V.B (2019) mean score of total sugar content of *shrikhand* samples in KS_1, KS_2, KS_3, KS_4 and KS_5 were 42.32, 43.43, 43.83, 43.25 and 41.68 percent respectively.

3.2.7 Reducing Sugar

It was observed that the average moisture content of finished product was to be found as 42.28±0.01, 42.25±0.02, 42.22±0.02, 42.20±0.01 and 42.17±0.02 per cent for treatment T_0, T_1, T_2, T_3 and T_4 percent respectively. Srinivas, J. *et al.,* (2017) it shows that average mean scores of reducing sugar ranges from 2.21% and 2.53 in the sample. Also, the results were also in accordance with the **(**Raghuwanshi, R.T. *et al.,* 2019) in which fresh *shrikhand* contained on an average 2.96 per cent.

3.2.8 Total Ash

The average protein content of the *shrikhand* samples was found to be 0.57±0.001, 0.57±0.001, 0.58±0.001, 0.58±0.001 and 0.58±0.001 per cent for treatment T_0, T_1, T_2, T_3 and T_4 percent respectively. **(**Chorage *et al*., 2018) it also reported that ash content of *shrikhand* for treatment T_0, T_1, T_2, T_3 and T_4 were 0.53, 0.51, 0.47 and 0.45 per cent, respectively. Also, the results were also in accordance with the (Singh, S.B., and Kumar, P. 2017) they also reported that ash content of wood apple pulp *shrikhand* for treatment T_0, T_1, T_2 and T_3 were 0.88, 0.82, 0.77 and 0.74 per cent, respectively.

3.2.9 Total solids

It was observed that the average moisture content of finished product was to be found as 58.00±0.01, 58.31±0.02, 58.37±0.01, 59.25±0.03 and 59.42±0.02 per cent for treatment T_0, T_1, T_2, T_3 and T_4 percent respectively. **(**Sameem *et al*., 2018) found similar results in n dragon fruit pulp added *shrikhand* the mean value for total solid of *shrikhand* samples were observed as 57.33, 56.03, 54.75 and 53.48 for T_0 T_1, T_2 and T_3 respectively. **(**David, 2015) reported that the highest mean value for total solids percentage in *shrikhand* with basil (*Ocimum basilicum*) extract was 60.12 per cent.

Conclusion:

From the above results it can be concluded that, sensorily superior quality *shrikhand* can be prepared from treatment T_2 ie, from 50 per cent cow milk and 50 per cent goat milk with 40 per cent sugar. In physico-chemical properties, it is concluded that, as the percentage of goat milk is increased, there was significant increase in fat, protein, total solids and ash content and decrease in moisture, reducing sugar and total sugar content of *shrikhand*.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

3.

Referance

Agnihotri, M.K. and Pal, U.K., (1996). Production and quality of *Shrikhand* from goat milk. *The Indian Journal of Small Ruminants*, *2*(2), pp.24-28.

Bhandage, B.B., Chavan, K.R. and More, N.M., (2020). Physico-chemical evaluation of *Shrikhand* by using kiwi (Actinidia deliciosa) fruit pulp. *Journal of Pharmacognosy and Phytochemistry*, *9*(6), pp.661-663.

Chavan, P.B., Padghan, P.V. and Andharepatil, P.S., (2019). Studies on sensory evaluation of diabetic *Shrikhand* by using Jamun (Syzygium Cumini L.) Pulp. *Asian Journal of Dairy and Food Research*, *38*(4), pp.318-321.

Chilliard, Y., Rouel, J., Ferlay, A., Bernard, L., Gaborit, P., RaynalLjutovac, K., Lauret, A. and Leroux C. (2006). Optimising goat's milk and cheese fatty acid composition in improving the fat content of foods (Woodhead Publishing. pp. 281-312).

DAHD (GoI). (2019). Basic Animal Husbandry Statistics 2019-20. Department of Animal Husbandry and Dairying, Government of India, New Delhi. India.

David, J. (2015) Preparation of herbal *shrikhand* prepared with basil (*Ocimum basilicum*) extract. *The Pharma Innovation J* 4(8):81–84.

Deshmukh, N.M., Sawate, A.R., Sontakke, M.D. and Desai, G.B., (2017). Preparation and Sensory Evaluation of Probiotic *Shrikhand* added with Mango and Banana Pulp. *Trends in Biosciences*, *10*(4), pp.1165-1168.

Dresch, J. (1982). A plea for the goat. Production-Pastorale-et Societe. OAE 10:81-83.

FAOSTAT (2018). FAOSTAT- (Food and Agriculture Organization of the United Nations) Statistics database. http://www.faostat. fao.org

FSSR. (2011) The Food Safety and Standards Regulation, Chapter 2- Food Product Standards: Chakka and *Shrikhand*, Commercial Law Publishers (India) Pvt. Ltd, 204.

Food Safety and Standards regulations (2010) Ministry of Health and Family Welfare Notification, New Delhi.253p.

IS: 95321. (1980) Specification for Chakka and *Shrikhand*. Bureau of Indian standards. Manak Bhavan, New Delhi.

Jaybhay, V.B., Kamble, D.K. and Jadhav, S.R., (2019). Studies on physico-chemical quality of *Shrikhand* sold in Kolhapur city. *Journal of Pharmacognosy and Phytochemistry*, *8*(6), pp.2436-2438.

Kaur, N., and Toor, J. S. 2023. Cattle and Buffalo Milk Production and Marketing: A Study in Punjab State, India. *Mysore Journal of Agricultural Sciences*, ***57***(3).

Lakshmi, A., and Nagaraja, G. N. 2022. Constraint Analysis of Dairy Farmers along Rural-Urban Interface of Bengaluru North. *Mysore Journal of Agricultural Sciences*, ***56***(3).

Mehta Meena. Proximate analysis of branded *shrikhand. J of Food and Dairy Technol*. (2013). 1(2):9-12.

Pandya, A. J., and Ghodke, K. M. (2007). Goat and sheep milk products other than cheeses and yoghurt. *Small Ruminant Research*, 68(1-2), 193-206.

Pandya, A.J., Mohamed, M. and Khan, H., (2006) Traditional Indian dairy products. *Handbook of Milk of Non-Bovine Mammals*, pp.257-273.

Patel RS, Chakraborty BK. (1985) Standardization of *shrikhand* manufacturing process of lactic fermentation. Lelait 65:55-56.

Pathrikar, A.D., Patange, D.D., Mote, G.V., Udachan, I.S. and Lokhande, S.M., (2021). Process development for goat milk *shrikhand* added with kiwi fruit. *J Postharvest Technol*, *9*, pp.89-100.

Park YW, Chukwu HI. Macro-mineral concentrations in milk of two goat breeds at different stages of lactation. Small Ruminant Res (1989) 1:157-166.

Park YW. Hypo-allergenic and therapeutic significance of goat milk. Small Ruminant Res (1994) 14:151-159.

Raghuwanshi, R.T., Mankar, N.A., Deshmukh, P.A. and Deshmukh, S.B., (2011). Effect of Source and Storage Interval on Reducing, Non-Reducing Sugar Content of *Shrikhand*. *Journal of Dairying Foods & Home Sciences*, *30*(2), pp.105-109.

Sameem M, Dr. Singh A, Dr. Hossain SKA, Shaeeduddin. (2018) Studies on preparation of *shrikhand* by using dragon fruit pulp. *The Pharma Innovation J* 7(8):455-458.

Shaji, N. and Thomas, S. (2018). Development and quality evaluation of low fat *Shrikhand* from goat milk. *Indian Journal of Dairy Science*, *71*(2).

Sharma, S., Peter, S., harma, A., Kumar, A. and Rai, VP. (2017) Effect of incorporation of sapota pulp and cocoa powder on the physicochemical characteristics of *shrikhand*. *Asian J Dairy & Food Res* 36(1): 34-36.

Shridharrao, T.A. (2012) Development of Dietetic *Shrikhand* (Doctoral dissertation, NDRI, Karnal).

Singh, S.B. and Kumar, P., (2017). Study of wood apple blended *Shrikhand*. *The Pharma Innovation*, 6 (3, Part B), p.77.

Singh, M.K., Singh, S.K. and Chauhan, M.S., (2023). Exploring potential of goat based dairy farming in India and way forward. *The Indian Journal of Animal Sciences*, *93*(3), pp.243-250.

Srinivas, J., Suneetha, J., Maheswari, K.U., Kumari, B.A., Devi, S.S. and Krishnaiah, N., (2017). Nutritional analysis of value added *Shrikhand*. *Journal of Pharmacognosy and Phytochemistry*, *6*(5), pp.1438-1441.

Chauhan G, Nanda PK, Das A, Tomar S, Das AK. Low-calorie and carrot pulp incorporated shrikhand from low-fat cow milk: Optimization and quality evaluation. AIMS Agriculture & Food. 2024 Jan 1;9(1).

Maske PG, Wankhade BR, Bawaskar SS, Motghare AB. Study on Sensory Evaluation and the Optimum Levels of Calcutta Betel Vine (Piper betel) Leaves Extract in the Preparation of Shrikhand. Journal of Advances in Biology & Biotechnology. 2024 Apr 5;27(5):220-4.